

1                                    **AN ARRANGEMENT AND METHOD FOR**  
2                                    **CONNECTING A ROD END TO A HEADED PIN**  
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5            **Cross Reference to Related Application**

6                                    This application claims the benefit of U.S. provisional application Serial No.  
7                                    Serial No. 60/400,082, filed July 31, 2002 and is a continuation-in-part of copending U.S.  
8                                    application Serial No. 10/449,744, filed May 30, 2003.  
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10           **Background of the Invention**

11                                    This invention concerns mechanical connections between control rod ends and a  
12                                    pivot pin, as are commonly used to connect control rods to a pin in transmission linkages for  
13                                    automobiles.

14                                    In these connections, it is now usual to incorporate a soft elastomeric isolator  
15                                    between the rod and the pin to minimize the transmission of vibrations to a shift lever for  
16                                    example which is gripped by the hand of the driver of an automobile. A disadvantage of such  
17                                    isolators has been the looseness or lash introduced into the connection by the pin contact  
18                                    compressing the isolator material.

19                                    Such looseness has also been introduced by the clearances necessary to assemble  
20                                    the component parts of the connection.

21                                    Labor costs are also incurred by the need to fit together complex components to  
22                                    complete the connection when the automobile is assembled, and the need to insure proper  
23                                    assembly.

24                                    Another difficulty has been involved in attempting to reduce the force necessary

1 to fit the pin to the connection to simplify assembly while still insuring that an adequately high  
2 separation force would be required to disconnect the pin after the connection is made to prevent  
3 unintended disconnection.

4 It is the object of the present invention to provide an arrangement and method for  
5 connecting one end of a rod to a headed pin which incorporates a vibration isolator without  
6 introducing excessive looseness in the connection.

7 It is another object of the present invention to provide such an arrangement and  
8 method in which there are minimal clearances necessary for assembly purposes.

9 It is yet another object of the present invention to provide such an arrangement  
10 and method which requires only low installation forces while insuring that separation forces are  
11 sufficiently high to preclude unintended disconnection of the components.

#### 12 13 Summary of the Invention

14 The above recited objects and other objects which will become apparent upon a  
15 reading of the following specification and claims are achieved by an arrangement and method for  
16 connecting a rod end to a headed pin, the arrangement including a housing defining a pin  
17 receiving cavity with integral retention features in the cavity engaging the headed pin so as to be  
18 retained therein. A soft elastomeric isolator is interposed between portions of the housing and  
19 the one end of the rod. The housing is formed by assembling two housing pieces together so as  
20 to enclose the vibration isolator and the one end of the rod. Both housing pieces are preferably  
21 molded as a single part from a hard plastic, with a connecting integral hinge allowing the pieces  
22 to be swung together to bring complementary faces into abutment with each other.

1                   Molded contact prongs project inwardly from a recess portion of each housing  
2 piece, the recess of each housing piece together defining a pin receiving cavity. The contact  
3 prongs engage the underside of a head on the pin to capture the same when the assembled  
4 housing is pushed onto the pin.

5                   The contact prongs are shaped to be easily deflected by contact with a head on the  
6 pin to allow entry of the pin but to thereafter strongly resist pull out of the pin to provide a secure  
7 connection.

8                   The housing pieces are also formed with semicircular recesses which together  
9 form a generally cylindrical ribbed cavity which captures the isolator when the housing pieces are  
10 assembled together. Engaging features comprised of assembly prongs project from each abutting  
11 housing piece face, and are each received in a corresponding receptacle on the opposite piece  
12 face to fix the two housing pieces together. The isolator is comprised of a soft elastomeric  
13 material which is itself assembled or molded to a ribbed rod end to be secured thereto.

14                  The isolator has relatively thin thicknesses subject to compression to limit  
15 movement thereof as a result of its compression while preventing the transmission of vibrations  
16 from the rod end to the hard plastic housing and metal pin. An interference fit between the  
17 isolator and the portions of housing pieces moved into engagement with the isolator when the  
18 housing pieces are assembled together insures that no looseness or lash will be created at  
19 assembly as with previous designs, while not requiring an overmolding process.

20                  An orientation feature is molded integrally with the housing pieces preventing  
21 assembly to the pin in the wrong orientation to further simplify making of the rod end  
22 connection.

## Description of the Drawings

Figure 1 is a top perspective view of a rod-pin connection housing constructed according to the invention and assembled to an isolator and rod end.

Figure 2 is a perspective view from a steeper angle of the connection components shown in Figure 1.

Figure 3 is a perspective view of the two housing pieces prior to being swung towards each other with the rod end and isolator received in a recess of one of the housing pieces.

Figure 4 is a perspective view of the two housing pieces partially swung together with the rod end and isolator in position in the recess of one of the two housing pieces.

Figure 5 is a perspective view from one side of one of the two housing pieces positioned on a headed pin and receiving the rod end and isolator.

Figure 6 is a front view of the two housing pieces as molded connected together, shown in a spread apart position.

Figure 7 is a top view of a contact prong portion of one of the two housing pieces.

Figure 8 is a view of the section 8-8 taken in Figure 7.

Figure 9 is a view of the section 9-9 taken in Figure 7.

Figure 10 is an enlarged view of a rod end with a sectional view of an isolator disposed thereon.

## Detailed Description

In the following detailed description, certain specific terminology will be employed for the sake of clarity and a particular embodiment described in accordance with the

1 requirements of 35 USC 112, but it is to be understood that the same is not intended to be  
2 limiting and should not be so construed inasmuch as the invention is capable of taking many  
3 forms and variations within the scope of the appended claims.

4 Referring to the drawings, Figures 1 and 2 show a rod end connection housing 10,  
5 comprised of two housing pieces 12A, 12B assembled together with complementary faces 34A,  
6 34B (Figures 3, 4) thereof in abutment with each other and capturing a steel rod end 14 and  
7 isolator 16.

8 Figures 3, 4 and 6 show the housing pieces 12A, 12B separated prior to being  
9 assembled together.

10 Both housing pieces 12A, 12B are molded as one part, in an end-to-end  
11 relationship connected by an integral hinge 18. The housing pieces 12A, 12B are identical  
12 except for the reversal of locations of a series of assembly prongs 20 and mating prong  
13 receptacles 22.

14 The housing pieces 12A, 12B are molded from a hard plastic such as Dow  
15 Vydne™ (Nylon 66%, graphite filled 33%), Rockwell hardness scale M95 (ASTM D785) or  
16 similar materials so as to not be readily compressed by contact pressure exerted by the pin 24  
17 (Figure 5) to which it is to be assembled.

18 Each housing piece 12A, 12B is molded with a main portion 26A, 26B having a  
19 semicircular recess 28A, 28B which together form a generally cylindrical pin receiving opening  
20 when the housing pieces 12A, 12B are assembled together.

21 Similarly, generally semicircular ribbed recesses 30A, 30B are molded into end  
22 portions 32A, 32B.

1 Barbed assembly prongs 20 project normally from respective abutment faces 34A,  
2 34B of each housing piece 12, 12B, and are captured when inserted into complementary  
3 receptacles 22 by suitable ridges 21 formed in each receptacle capturing the barbed end of each  
4 prong 20 when inserted therein as the housing pieces 12A, 12B are swung together.

5 Each housing piece 12A, 12B is formed with a contact prong 36A, 36B extending  
6 parallel to the pin receiving recess 28A, 28B.

7 As shown in Figures 7-10, a lip portion 38 thereof is formed at an upper end of  
8 each contact prong 36A, 36B, having a sloping surface at the bottom adjacent the entry and of  
9 recess 28A and a relative blunt top surface 42 at the end of each contact prong 36A, 36B.

10 A clearance space 42 allows limited outward deflection during pin insertion until  
11 contact of a rib 44 with the outer wall defining recess 28A, 28B.

12 The sloping lip surface 40 of each contact prong 36A, 36B allows insertion of the  
13 pin 24 by radial deflection of the contact prong 36A, 36B while the pressure on the blunt top  
14 surfaces 42 is strongly resisted to prevent withdrawal and thus to provide high separation forces.  
15 These forces can be designed for by selection of the configuration of each contact prong 36A,  
16 36B.

17 The housing pieces 12A, 12B are also each integrally formed with a pin blocking  
18 orientation 21A, 21B respectively which extend over one end of the recesses 28A, 28B which  
19 block entry of the pin 24 from the wrong side.

20 The isolator 16 is molded from a soft elastomer such as the following  
21 thermoplastic polyester elastomers:

22 Dupont Hytrel™ 5526,

1 Bayer Desmopan™ 453, Shore hardness 53D (ASTM D2240)

2 Dupont Hytrel™ 4069

3 Bayer Texin 285

4 Bayer Texin 270

5 Bayer Desmopan™460

6 Novi Estane 58133 (formerly BF Goodrich).

7  
8 The isolator 16 is preferably molded onto the steel rod end 14 as shown in Figures  
9 3 and 10, although it could be separately molded and assembled thereto, which is formed with a  
10 wide groove 42 into which the material of the isolator 16 extends. The isolator 16 is itself  
11 formed with an intermediate groove 45 into which a land 46A, 46B on each housing piece end  
12 portion 32A, 32B extends to create a secure interlock. A land 48A, 48B of each end portion  
13 32A, 32B also projects over a shoulder 50 of the isolator 16 to further strengthen the connection.

14 As shown in Figures 4 and 5, the isolator 16 completely encloses the rod end 14 to  
15 prevent any direct contact with the housing pieces 12A, 12B, but the sections which are subjected  
16 to compression during service are relatively thin, i.e., 1 mm or less. Also, there is an absence of  
17 any points of concentrated compressive stress as occurred when a headed pin was made to bear  
18 on a soft elastomeric isolator, such that excessive lash is avoided.